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ABSTRACT

Oregon agricultural sciences and technology (AST) teachers' perceptions of the impact of integrating science into agricultural education programs were examined. Questionnaires were mailed to all 111 Oregon AST teachers employed during the fall 1997 semester. Usable replies were received from 106 teachers (response rate, 95.5%). Respondents were asked to respond (based on a 5-point Likert scale) to 42 statements regarding integrating science into agricultural education. The AST teachers generally supported the following statements: integrating science assists students in better understanding science concepts and their application to agriculture; AST teachers need more preparation time before they can integrate science concepts; administrators should schedule planning time to prepare AST teachers to integrate science into their programs; the most significant barriers to integrating science into agricultural education are equipment and funding; undergraduates in teacher preparation programs do not necessarily need more science courses, but they do need more instruction in how to integrate science; practicing AST teachers need more inservice training in integrating science into the AST curriculum; and integrating science into the AST curriculum is an important component in helping students meet the standards involved in Oregon's Certificate of Initial Mastery and Certificate of Advanced Mastery. (Contains 19 references and 7 tables.) (MN)

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# Agriculture Teachers' Perceptions of Integrating Science in Oregon Agricultural Science and Technology Programs

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# AGRICULTURE TEACHERS' PERCEPTIONS OF INTEGRATING SCIENCE IN OREGON AGRICULTURAL SCIENCE AND TECHNOLOGY PROGRAMS

## Introduction/Theoretical Framework

The need to integrate academics into the traditional vocational agriculture program was clearly outlined in the National Academy of Sciences report Understanding Agriculture: New Directions for Education (1988). As a result, a distinct charge was given to researchers to define the methods necessary to guide educators as they updated their curriculum.

The pressures of increasing state standards have caused concern among many agricultural educators in Oregon. Increased high school graduation requirements have put pressure on agricultural programs by limiting opportunities for students to enroll in elective courses. Changing college entrance requirements have further challenged secondary agricultural educators to make their programs become more than just 'vocational'. Johnson (1995) reported that Arkansas teachers perceived that offering science credit for agriculture courses would increase enrollment, benefit students, and enhance the program image.

Policymakers, educators, employers, scholars, and social critics have advocated vocational education reform that dealt with 'integration' (Stasz, Kaganoff, & Eden, 1994). According to researchers (Stasz and Grubb, 1991; O'Neil, 1992), vocational educators as well as critics of vocational education viewed integration of academics as a curricular reform that improved the academic content of vocational education and helped prepare students for employment in an ever-changing world of work.

Although many benefits exist for the integration of academics into vocational education, several barriers limit the integration of academic and vocational education. Roberson, Flowers, and Moore (1997) stated that a lack of strong teacher support of the educational reform in North Carolina may be related to the many barriers teachers encounter when attempting to integrate vocational and academic curricula. It could be helpful when planning curriculum changes to be aware of the potential factors which could limit the success of the effort. Furthermore, Roberson, Flowers, and Moore (1997) recommended that teacher workshops be focused on training teachers to use specific models of vocational and academic integration and reducing time requirements of vocational and academic integration.

Examples of successful in-state integration projects include Michigan's Agriscience and Natural Resources Education curriculum (Elliot, Connors and Steelby, 1991), California's Science and Agriculture Curriculum Project (Emery and Linder, 1993), and Mississippi's Agriscience curriculum project (Newman and Johnson, 1994). Furthermore, Miller (1997) reported that the Southern Regional Education Board's (SREB) 'High Schools That Work' program, initiated in 1987, now includes more than 650 high schools in 21 states, all of which are integrating vocational and academic curriculum at some level. As a result of the work in Michigan, Elliot and Connors (1994) recommended others review their findings to assist in developing their own in-state curriculum changes.

Agricultural education teacher trainers can benefit from reviewing current research to establish a baseline for curriculum changes in their own states. As a result of research in Louisiana, teacher trainers found that educators perceived in-service workshops to be the most effective means for learning about biotechnology (Kirby, 1990). Neason (1992) stated:

> The development of teacher in-service programs is the next step for implementing the revised agricultural science curricula. Information is needed to identify the technical areas which teachers feel they need in-service assistance in. This information will serve as a basis for planning in-service programs.

In developing an in-service educational program assessing learner needs is an important first step in the process. Waters and Haskell (1989) emphasized that involving the learners in the process of planning an in-service education program increases the likelihood of implementing relevant programs. Furthermore, Norris and Briers (1989, p.42) stated "teachers' perceptions toward the change process (need for the change, amount of teacher input into the change process, and manner in which the change was managed, etc.) is the single best predictor of the teacher's...decision concerning adoption of the change." And finally, Fullan (1991) indicated, even the most promising innovation may be doomed to failure if teachers do not support its implementation.

## Purpose/Objectives

The purpose of this study was to determine how Oregon Agricultural Science and Technology (AST) teachers perceived the impact of integrating science on agricultural education programs. To fulfill the purposes of the study, the following research questions were addressed:

1. What were selected demographic variables of Oregon AST teachers?
2. What were the perceptions of AST teachers concerning integrating science and agriculture?
3. What were the perceptions of AST teachers concerning teaching integrated science?
4. What were the perceived barriers to integrating science into the agricultural education program?
5. What were the AST teachers' perceptions concerning the role of teacher preparation programs in integrating science into agricultural education programs?
6. What were the AST teachers' perceptions concerning student enrollment since integrating science into their agricultural education program?

7. What were the AST teachers' perceptions concerning support of the agricultural education program since integrating science?

8. What effects will state standards have on agricultural education programs as perceived by AST teachers?

## Methods/Procedures

The target population for this study consisted of current Oregon Agricultural Science and Technology (AST) teachers (N = 111). The sample population consisted of all Oregon AST teachers employed during the fall 1997 semester (N = 111) that responded to the mail-in survey. The Oregon Department of Education provided the researchers with a current database containing the name and school address of each teacher. Caution should be exercised when generalizing the results of the study beyond the accessible sample.

The Integrating Science Survey Instrument developed by Thompson and Schumacher (1997) was used to identify the perceptions of the AST instructors. Three additional questions were added to the survey to acquire state specific information. Validity of the instrument was established by the authors (Thompson and Schumacher, 1997). As a measure of the reliability of the attitude scale, internal consistency was established using Cronbach's alpha ($\alpha$ = .88 pilot study, and .81 Instrument).

The survey instrument and cover letter were mailed to the subjects. Two weeks after the initial mailing, a telephone call was placed and/or an e-mail message was sent to all non-respondents. Usable responses were received from 106 teachers for an overall response of 95.5 %. Nonresponse error was controlled by comparing early and late respondents on the mean attitude scales using a t-test. The t-values showed the attitude means were not statistically significant.

## Results/Findings

The average respondent was 41 years of age (SD = 9.3), had 14.3 years of teaching experience (SD = 8.95) and had taught approximately 11 years at their current school (SD = 8.4). While 92% of the respondents were male, 8% were female. Over 77% of the respondents had been enrolled in agricultural education while in high school with almost 61% of those enrolled, completing four years of high school agricultural education courses.

The respondents indicated that 84% had participated in inservice workshops/course(s) that taught them how to integrate science. Of the 84% that attended integrating science workshops, 18% had participated in one workshop, 23% had participated in two workshops, 12% had participated in 3 workshops, and 22% had participated in four or more workshops that taught them how to integrate science. While 49.5% of the respondents indicated their students receive science credit for agricultural education classes in their school, 50.5% indicated students in their classes do not receive science

credit for agricultural education classes. One in every five (23%) respondents reported they currently have a teaching license with a science endorsement.

The respondents were asked to respond to 42 statements regarding integrating science into their Agricultural Education Programs. Their responses were measured using a five point Likert-type scale where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree. Cronbach's Alpha for reliability was .80

The raw mean scores on the 42 Likert-type items ranged from a low mean of 2.66 for the item, "the lack of agriscience jobs in the local community is a barrier to integrating science in the agricultural education program" to a high score of 4.52 for the item "Science concepts are easier to understand for students when science is integrated into the agricultural education program." The respondents rated 11 (26.2%) of the items 4.00 or higher while 38 (90.5%) of the items received mean ratings of 3.00 or higher. Only four (9.5%) of the items received a mean score less than 3.00.

Table 1 presents the means and standard deviations for Oregon AST teachers' perceptions of integrating science. Research question number 2, "Agriculture and Science" contained seven items with mean scores that ranged from 3.69 – 4.52. The items within this category had the highest mean scores for the five categories with only one item that had a mean below 4.00.

Table 1

Teacher's Perceptions of Integrating Science and Agriculture (N = 106)

| Agriculture and Science Item | M | SD |
|---|---|---|
| Science concepts are easier to understand for students since I integrated science into the agricultural education program. | 4.52 | .53 |
| People pursuing a career in agriculture must have a greater understanding of biological science than ten years ago. | 4.51 | .64 |
| Students are more aware of the connection between scientific principles and agriculture when science concepts are an integral part of their instruction. | 4.47 | .55 |
| Students are better prepared in science after they completed a course in agricultural education that integrated science. | 4.40 | .65 |
| Students learn more about agriculture when science concepts are an integral part of their instruction. | 4.18 | .72 |
| People pursuing a career in agriculture must have a greater understanding of physical science than ten years ago. | 4.18 | .72 |
| Students are more motivated to learn since I integrated science into the agricultural education program. | 3.69 | .82 |

Research question number 3, "Teaching Integrated Science" contained six items with mean scores that ranged from 3.38 – 4.00 (Table 2). The respondents agreed (a mean greater than 4) with one statement: "Integrating science into the agricultural education program requires more preparation time for me than before I emphasized integrated science concepts in my agricultural education program."

Table 2

Teachers' Perceptions Toward Teaching Integrated Science in Their Agricultural Education Program (N = 106)

| Teaching Integrated Science Item | M | SD |
|---|---|---|
| Integrating science into the agricultural education program requires more preparation time for me than before I emphasized integrating science | 4.00 | .87 |
| I feel prepared to teach integrated biological science concepts. | 3.92 | .90 |
| I teach integrated science concepts in agricultural education that focus more on the biological science concepts than the physical science concepts. | 3.85 | .89 |
| I feel prepared to teach integrated physical science concepts. | 3.69 | .83 |
| Integrating science into agriculture classes has increased my ability to teach students to solve problems. | 3.62 | .69 |
| I have integrated more science in the advanced courses than the introductory courses that I teach in agricultural education. | 3.38 | .98 |

Two open-ended questions were asked to teachers regarding integrating science into the agricultural education program. Teachers were asked what had to be given up or what they will have to give up to develop a more integrated science curriculum. Of the seventy-one responses to this question, the most common response was: nothing (43.66%), followed by traditional agriculture classes (15.49%), time (12.68%), and hands-on activities such as agricultural mechanics (11.27%). The most commonly listed items that caused or will cause the respondents to integrate science were: update curriculum (22.66%), the need to integrate agriculture and science (21.33%), student needs (20%) and enrollment (10.67%).

Research question number 4, "Barriers to Integrating Science" contained nine items with mean scores that ranged from 2.66 – 4.07 (Table 3). Only one item in this category received a mean score over 4.0. Respondents agreed (a mean greater than 4) that the lack of appropriate equipment is a barrier to integrating science. The data indicated respondents were undecided (a mean greater than 3 and less than 4) with eight of the nine statements regarding barriers to integrating science. This category also had the lowest mean scores.

Table 3

Perceived Barriers to Integrating Science In Agricultural Education Programs (N = 106)

| Barriers to Integrating Science Item | M | SD |
|---|---|---|
| Lack of appropriate equipment is a barrier to integrating science. | 4.07 | .90 |
| Lack of adequate federal, state, or local funds is a barrier to integrating. | 3.66 | 1.08 |
| Lack of agriscience workshops for agricultural education teachers | 3.58 | .93 |
| Lack of science competence among teachers in agricultural education | 3.23 | 1.00 |
| Lack of an integrated science curriculum is a barrier to integrating science | 3.16 | 1.01 |
| Lack of close proximity to high-technology firms is a barrier to integrating | 2.97 | .99 |
| The Lack of student preparation (prior to enrolling in agricultural education) in science is a barrier to integrating science into agricultural education. | 2.95 | 1.00 |
| The lack of a science teacher who is willing to help me integrate science concepts has been a barrier to integrating science in the ag. ed. program. | 2.73 | 1.03 |
| The lack of agriscience jobs in the local community is a barrier to integrating science into agricultural education programs. | 2.66 | .94 |

Research question number five, "Teacher Preparation Programs" contained six items with mean scores that ranged from 3.38 - 4.26 (Table 4). Oregon AST teachers agreed (mean scores greater than 4) that teacher preparation programs should provide instruction for undergraduates and inservice for teachers on how to integrate science into the agricultural education program.

Table 4

Teachers' Perceptions Concerning the Role of Teacher Preparation Programs in Integrating Science in Agricultural Education Programs (N = 106)

| Teacher Preparation Programs Item | M | SD |
|---|---|---|
| Teacher preparation programs in agriculture should provide instruction for undergraduates on how to integrate science. | 4.26 | .70 |
| Teacher preparation programs should provide inservice for teachers in the field on how to integrate science into their agricultural education program. | 4.21 | .70 |
| Teacher preparation programs should require that students conduct their early field experience program with a teacher that integrates science into the agricultural education program. | 3.39 | .89 |
| Teacher preparation programs in agriculture should require students to take more basic science courses. | 3.38 | 1.03 |

Research question number six, "Student Enrollment" contained five items with mean scores that ranged from 3.14 - 3.72 (Table 5). No items in this category had mean scores that were over 4.0. The respondents were undecided (mean scores greater than 3 and less than 4) as to the effect integrating science has had on AST program enrollment. Further analysis of frequencies indicated that 71% of the respondents agreed or strongly agreed that high ability students are more likely to enroll in agricultural education courses that integrate science.

Table 5

Teachers' Perceptions Concerning Student Enrollment Since Integrating Science into Their Agricultural Education Program (N = 106)

| Student Enrollment Item | M | SD |
|---|---|---|
| High ability students are more likely to enroll in agricultural education courses that integrate science. | 3.72 | .92 |
| Average ability students are more likely to enroll in agricultural education courses that integrate science. | 3.53 | .82 |
| Total program enrollment in agricultural education has increased since I integrated science. | 3.52 | .88 |
| Integrating science into the agricultural education program more effectively meets the needs of special population students. | 3.33 | 1.03 |
| Low ability students are more likely to enroll in agricultural education courses that integrate science. | 3.14 | 1.07 |

" Program Support" contained six items with mean scores that ranged from 3.51 - 3.79 (Table 6). No items in this category had a mean score above 4.00. The respondents were undecided (mean scores greater than 3 and less than 4) as to groups of people that have increased support since integrating science into the agricultural education program.

Table 6
Teachers' Perceptions Concerning Program Support Since Integrating Science into Their Agricultural Education Program (N = 106)

| Program Support Item | M | SD |
|---|---|---|
| Local administrator support has increased since I have integrated more science into the agricultural education program. | 3.66 | .80 |
| Parental support has increased since I have integrated more science into the agricultural education program. | 3.62 | .75 |
| School counselor support has increased since I have integrated more science into the agricultural education program. | 3.60 | .79 |
| Community support has increased since I have integrated more science into the agricultural education program. | 3.53 | .76 |
| Science teacher support has increased since I have integrated more science into the agricultural education program. | 3.38 | .86 |
| Other teacher support has increased since I have integrated more science into the agricultural education program. | 3.30 | .80 |

Research question number eight (Table 7) contained three items that addressed state standards or Certificate of Initial Mastery (CIM) and Certificate of Advanced Mastery (CAM). Two of the three items in this category had mean scores that were above 4.0. Respondents agreed that integrating science will support AST Programs by helping students meet CIM/CAM requirements (mean = 4.21) and that integrating science will help align AST programs with emerging educational standards (mean = 4.17).

Table 7

Teachers' Perceptions Concerning Program Support Since Integrating Science (N = 106)

| Meeting State Standards Item | M | SD |
|---|---|---|
| Integrating science will support AST Programs by helping our students meet CIM/CAM requirements. | 4.21 | .66 |
| Integrating science will help align AST Programs with emerging educational standards (CIM/CAM). | 4.17 | .61 |
| State standards (CIM/CAM) will be an asset to what I am trying to do in my AST Program. | 3.64 | .89 |

Respondents were asked to respond to an open-ended question concerning changes that AST Programs would have to go through to meet state standards (CIM/CAM). Of the 66 responses, most teachers felt that no changes (42.42%) would have to be made to meet state standards. Integrating science (15.15%), and don't know (13.63%) were the changes most often listed that respondents felt would have to be made to meet state standards.

## Conclusions and Recommendations

Based on the findings of this study, the following conclusions and recommendations were drawn:

Almost one fourth of Oregon's AST teachers reported having a teaching credential with a science endorsement, while 50% of the teachers indicated their students receive science credit for agricultural classes in their school. Teachers should be encouraged to earn their science endorsement, especially if they desire to teach agriculture for science credit.

Oregon AST teachers believed that integrating science assists students in better understanding science concepts and their application to agriculture. This concurs with the findings of Enderlin and Osborne (1992) and Thompson and Schumacher (1997) that integrating more science will produce more science literate students who are better prepared to compete in today's society.

Oregon AST teachers indicated they need more preparation time than before they emphasized integrated science concepts. Oregon Agricultural Science and Technology (AST) teachers should be appropriated more time to integrate science into their Agricultural Education Programs. Administrators should schedule planning time for teachers to better prepare them to integrate science. If administrators truly believe that integrating science in agricultural education programs assists students in better understanding science concepts, then additional planning time will be worth the effort. At the same time, if teachers truly believe that integrating science is beneficial to students, they will manage their time to better prepare themselves to integrate science.

Although Oregon Agricultural Science and Technology teachers didn't agree on specific barriers to integrating science, the participants indicated the most significant barriers dealt with equipment and funding. With the budget constraints in schools across the state, teachers may need to explore grant funding and business partnerships to assist in integrating science into the curriculum. Creative funding may be the catalyst to integrating science in many agriculture programs.

Undergraduates in teacher preparation programs will be better prepared to teach science concepts if they receive instruction on how to integrate science. Undergraduates don't necessarily need more science courses, but more instruction on how to integrate science. Teacher preparation programs should also provide more inservice for teachers on how to integrate science into their agricultural education curriculum.

Oregon AST teachers felt that integrating science is an important component in helping students meet the standards involved in Oregon's Certificate of Initial Mastery (CIM) and Certificate of Advanced Mastery (CAM). Teachers believe that integrating science will help align Agricultural Science and Technology (AST) Programs to meet educational standards. Will agriculture programs survive this round of educational reform and state standards? It is the belief of many Oregon agriculture teachers that little or no changes will have to take place in agricultural education programs to facilitate educational reform. Further research is needed to determine if administrators and school boards hold the same perceptions.

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